DOCUMENT RESUME

ED 325 802 CS 010 279

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TITLE Schema Theory and Reading Comprehension.
PUB DATE 90
NOTE 28p.
PUB TYPE Information Analyses (070) -- Viewpoints (120)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Learning Theories; Literature Reviews; *Reader Text Relationship; *Reading Comprehension; Reading Strategies; *Schemata (Cognition); *Text Structure
IDENTIFIERS *Schema Theory; Text Factors

ABSTRACT

Two main types of schemata exist for reading: content schema, representing existing knowledge of objects and events; and textual schema, including knowledge of discourse structure and conventions. There are at least six major schema functions important to reading comprehension: (1) schemata provide slots for assimilating additional knowledge; (2) schemata aid in judging what is important; (3) schemata aid in making inferences; (4) schemata help summarize and edit material; (5) schemata activated during reading facilitate an orderly memory search for relevant information; and (6) schemata function in inferential reconstruction. It is not clear how the size of schemata effects per se can be offered as evidence for remembering versus learning. Linguistic and metalinguistic schemata are aids to reading comprehension. Students will have better recall if they make use of text structure schemata. Schema theory can help explain failure to comprehend: there may not be enough clues to activate existing schemata, the reader may not have appropriate schemata, and failure to comprehend may result when the reader makes an interpretation but not the one intended. Schema theory has its limitations--for example, it makes too much of an attempt to fit something as evidently complex as knowledge acquisition, storage, and retrieval into a simple, familiar framework-prototype. (Forty-one references are attached.) (RS)

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# SCHEMA THEORY AND READING COMPREHENSION

## Background, Definition, and General Discussion

Garner describes a schema as "an abstract knowledge structure derived from repeated experience" and schemata as "expectations which guide encoding and retrieval" (Garner, 1987).

Theorists stress that each schema is an organized body of knowledge which embeds in others and that it is important to account for the relationships among these elements, not just meanings, as well as how this knowledge is used for both output and input (Anderson, 1984; Bransford & Johnson, 1972; Norman, 1982). Schema theory attempts to show how we encode new information, store it, and retrieve it (Glover, Ronning, & Bruning, 1990). The inclusion of action processes differentiates schema theory from earlier semantic networks models.

## Categories of Schemata

Two main types of schemata exist for reading (Garner, 1987). The first type, content schema, is existing knowledge of objects and events, both domain-specific and more general world knowledge (McNeil, 1987). What we already know, our prior knowledge, constrains our comprehension and memory for what we read. The other type is textual, our knowledge of discourse structure and conventions, such as how stories in our culture unfold, how writers

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typically provide aids to understanding, and how text format provides clues to meaning. This, too, influences our ability to think along with the writer and guides our predictions.

## Functions of Schemata

There has been much written about schema theory, and authors approach this abstract concept from different perspectives. Various organizational patterns and even terminology tend to obscure similarities in their views, and I have found this topic exceedingly complicated to organize. Each subtopic seems to require understanding of the others, making it difficult to decide where to begin. (Where does one schema end and the next start?) There are at least six major schema functions important to comprehension (Anderson, 1984; Bransford, 1984.) I recognize that there is much overlap among the functions and that for presentation ease I may be oversimplifying and making artificial distinctions among the categories. These functions affect both content and text schemata, but the discussion will focus primarily on content schemata.

### I. Schemata provide slots for assimilating additional knowledge.

Schema theorists point out that appropriate schemata are not merely useful, but fundamental to comprehension (Anderson, 1984; Bransford, 1984). New knowledge is only meaningful and assimilated easily if schemata can be activated during learning. New pieces of information, both micropropositions and macropropositions, attach to

preexisting schemata. When slots have received information of certain types (constraints) from either the environment, memory, or inference (default), they are said to be **instantiated**. The information is then stored in memory in a predetermined relationship with other schemata (van Dijk, 1983). [Schank (1979) calls these Memory Organization Packets.] One can imagine an extremely complex network of organized storage that Rumelhart and Ortony (1977) describe as "encyclopedic."

(This function does not clearly describe how one understands novel situations for which prepackaged schemata are unavailable. I will address this question later.)

**II. The second major function of schemata involves judging what is important.**

To study how readers determine importance, researchers tend to examine how they allocate attention by measuring eye fixations, time involved, response time to a probe, pupil dilation, and brain waves. Four ideas have emerged.

(a) Britton (1978) has promoted the prevailing hypothesis of <u>selective attention</u>. His subjects spent more time on sections of a passage most relevant to predetermined questions. They also took longer to react to probes given while they were reading these portions. In a later study by Anderson and Pearson (1984), poorer readers were as fast as better readers when reading macrostructures but considerably slower on micro-elements, presumably those on which

they were to be tested. However, when subjects knew they would have an essay test, they spent more time on the macrostructures.

(b) On the other hand, ideational scaffolding supporters allow that information which readily fills an empty slot does not warrant extra attention and takes less time to process.

(c) Kintsch and van Dijk (1978) believe that important ideas remain in working memory longer when secondary propositions come in. This multiple cycling permits deeper processing.

(d) A fourth theory posits that importance is solely a function of memory and is not actually considered at the moment of learning. This hypothesis might at first seem untenable and is, in fact, less accepted, but we may wish to note Anderson and Pearson's (1984) caution that experiments tend to turn reading into studying. This further complicates the question of how readers select information to be processed in more natural settings. Is it a function of memory? Is the process so automatic that we only notice it when "studying"?

III. Making inferences is the third and one of the most important roles of schemata.

What kinds of inferences do people make? Warren, Nicholas, and Trabasso (1979) compare three types of inference "event chains" to parts of a house. Logical inferences are the studs of the house and provide answers to the questions "Why?" and "How?" about the motivations, psychological and physical causes, and conditions which enable actions. Information inferences are the walls and floorboards

and answer Who? What? When? and Where? questions. These inferences tend to explain pronouns, references, space, and time. Value inferences are the inspectors which evaluate and judge.

Anderson and Pearson (1984) list four examples of occasions when readers make inferences. (a) One is guessing which initial schemata may be pertinent, particularly when no definitive framework is given.

(b) Likewise, inferences help draw conclusions without complete knowledge. Since this often happens at the time of retrieval, this task will be discussed in more detail in the section under inferential reconstruction.

(c) A third inference task is instantiating unlabeled slots. For example, in a ship-christening passage (Anderson & Pearson, 1984) Queen Elizabeth is present, and we know from past experience that celebrities christen ships, by inference we may predict that she will be the person who will christen the ship, even though the passage does not say that she, or any celebrity will do it. Here, the reader inferences the connecting schema, "celebrity," from the subschema, Queen Elizabeth, and the superordinate schema, ship christening. Later reading may or may not verify this assumption.

(d) The fourth instance of inferring, assigning default values when information is unclear or missing, is so common that we are often unaware of its occurrence until contrived reading situations, such as the paragraph on washing clothes (Bransford & Johnson, 1972, in Glover, 1990; Rayner & Pollatsek, 1989), call it to our atten-

tion. When we know the superordinate schema, we can supply knowledge from past experiences to clarify unclear or missing information. For example, in Anderson, Reynolds, Schallert, and Goetz's (in Anderson, 1984) experiment, when Rocky is a wrestler, "lock" has a different meaning than it does if Rocky is a prisoner. With the title, we "automatically" provide information from past experiences.

Passages such as Bransford and Johnson's (1972, in Anderson, 1984) modern-day Romeo and their description of washing clothes are practically unintelligible without a frame from which to interpret them.

The text constrains <u>how</u> inferences are made and affects the tenacity with which readers retain their inferences (Warren, Nicholas, & Trabasso, 1979). (a) Readers may invent settings, events, or judgements about what they are reading which are consistent with but not directly determined from the text. They will likely abandon these easily if later contradicted. (b) Some inferences are determined by the text but are not critical to what happened and why. These add interest and color but are not crucial. Once made, however, they are as difficult to contradict as (c) determined, relevant inferences. (d) Overconstrained inferences, or those which add nothing new, are omitted or forgotten easily. This commitment to inferences, made correctly or incorrectly, surfaces again in later discussions.

IV. The fourth major function of schemata is to help summarize and

edit material.

Readers (even experts) are able to construct main ideas more easily from text for which they have prior knowledge (Afflerbach, 1990). They also restructure information to be more meaningful, examine it for parts disputed or already known, or condense it to omit the trivial (Glover, 1990; Anderson, 1984). This seems to occur at the time of output as well as input. Individuals are more likely to report material of which they are unsure, but regard as relevant. They are not likely to report less relevant material even if they are more certain of it. This selecting/rejecting evidently occurs after conscious deliberation. This is not the case for the differences in recall when perspectives change, as in the home buyer/burglar study (Anderson & Pichert, 1978 in Anderson, 1987). In this situation, subjects apparently did not access information until switching roles.

V. Schemata activated during reading facilitate an orderly memory search for information relevant to the topic.

This memory search appears to operate top-down, along an outline, so it is highly likely that what it does find will be related. Furthermore, it will not turn up material that has not been related.

The interactive view of reading comprehension maintains that reading does not proceed entirely from words to thought nor is thought solely responsible for how we understand what we read. Rather, we simultaneously use sensory, syntactic, semantic, and

pragmatic information (Garner, 1987). This view accommodates both "bottom-up" and "top-down" theories. Data-driven activity (from parts) elicits dominating schemata (the whole). A conceptually-driven, "top-down" search begins with the whole and activates subschemata, the parts. Once candidate variables have been selected, there seems to be an evaluation process checking "goodness of fit." This interpretative framework is fundamental for comprehension (McNeil, 1987). In this view, understanding becomes an act of problem-solving (Mayer, 1983).

Several studies discount the notion that passage meaning is the sum of the meaning of words. Contrived texts such as those cited earlier have been useful to demonstrate dramatically how much we depend upon prior knowledge to understand what we are reading. Studies with more natural text also show this effect. Pearson, Hansen, and Gordon (1979) tested second-graders' knowledge of spiders. Children with high knowledge comprehended a spider passage better than did children with limited knowledge. Chiesi, Spilich and Voss (1979, in Anderson, 1984) had similar results with a baseball passage. Those with a more highly developed baseball schema outperformed those with less knowledge, regardless of reading ability.

Collins and Quillian (in Anderson & Pearson, 1984) believe that the finite human memory practices "cognitive economy." Attributes are not assigned to a subordinate schema if they exist for a higher one. For example, we need not remember that robins, parakeets, and eagles have feathers and lay eggs since we know that birds, a higher

schema, do. Feathers and egg-laying are necessary features of birds. Nor do we need remember that robins, parakeets, and eagles fly. But flying is merely a characteristic feature of birds, not a necessary one. Ostriches and penguins do not possess this characteristic; they require extra memory attention. The schema network allows contradictions and exceptions (Norman, 1982).

VI. The sixth schema function is inferential reconstruction.

We do not remember like tape recorders (Mayer, 1983). Rather, we store key points in existing structures and use general knowledge to reconstruct events. If memory fails, schemata permit intelligent guessing about that which was forgotten. In the restaurant experiment (Anderson, Spiro, & Anderson, 1978), for example, one might guess that the wine that went with the fish meal was white based on prior experience.

Recht and Leslie (1988) used both quantitative (number of questions answered correctly) and qualitative (comparison to expert) and found that students with high prior knowledge for baseball performed better than those with low prior knowledge regardless of reading ability. That is, those with high ability/low knowledge did no better than those with low ability/low knowledge. Likewise, those with high ability/high knowledge did no better than those with low ability/high knowledge.

A reconstructive memory system requires much less "space" than a "readout" system (Glover, 1990), but it is subject to error in re-

construction. Experimenters have verified the tendency for individuals to "remember" that which seems plausible according to their own schemata, whether they had actually read it or not. People also tend to distort what they remember so that it becomes consistent with their beliefs (Read & Rossen, 1981).

Bartlett (1932) was one of the first to suggest that memory is a reconstructive process by which individuals add, blend, omit, and otherwise transform what they have read based upon their prior knowledge. He had British subjects read an Indian tale, "The War of the Ghosts." Not only was their recall of the story a British adaptation of the original, but it became even more so as time went by. Mandler and Johnson (1977 in Garner, 1987) also found that the longer the delay in the retelling, the more likely it was that stories would fit the subject's ideal. In other words, schemata effects increase over time.

In the Bartlett study and in Anderson's restaurant/supermarket experiment, it is difficult to decide whether the information was actually forgotten or never stored in the first place. Evidence suggests that it may have been there but dormant. Subjects read a passage which included a description of a house and recalled details of it from the perspective of either a burglar or a home buyer (Anderson and Pichert, 1978). It is interesting that when they switched roles, they were able to recall information that became relevant to the new situation. For example, an unlocked back door which was not mentioned by the home buyer, became important from the

point of view of the burglar. Furthermore, subjects reported that they suddenly remembered these features, rather than just having neglected to mention them earlier. This suggests that remembering is an active process, a search for relevant elements in the activated storage units and that the details were there, just stored in different schemata.

This raises the issue of a can/do distinction (Freedle, 1979). Of course, features of houses benefit from our prior knowledge and information that fits into existing schemata is easy to search. Steffensen, Joag-Dev and Anderson (1979 in Anderson, 1984) asked American and Asian-Indian subjects to read passages describing a wedding from each culture. As expected, they recalled more information, better judged the importance of details, and took less time with the culturally same passage. One wonders how they would have responded to probes for further information.

## Learning versus Remembering

Anderson and Pearson (1984) caution us against calling an activity "remembering" unless its effects are above and beyond that which we can attribute to learning. They believe that larger effects for schemata point to a case of remembering and that schemata effects diminish when learning is at issue. This is an interesting comment and raises several questions. First, it implies that unlearned information is that which is unassigned at input. No doubt this information would be lost almost immediately. But how can in-

creasingly more unassigned information be lost as delay increases? Where was it if it were not stored? And if it were stored, even briefly, then it was assigned and therefore learned by their own reasoning. Certainly, learning may diminish over time (retroactive and proactive interference), but the loss of this information is usually considered forgetting, evidence for a case of memory, not learning. Therefore, either learning or memory failure could cause loss of information.

Furthermore, it is equally possible that we may subtly, unknowingly, augment our learning on the topic. Yet, according to this view, any increase of knowledge would indicate a case of remembering, not learning. So I am not clear about how the size of schemata effects per se can be offered as evidence for remembering versus learning unless they consider only schemata effects that are inaccuracies. Added inferences which are inaccurate would indeed be stronger support for this hypothesis. Accurate additions, on the other hand, might be a result of inferential reconstruction (memory) or additional learning.

## Schemata for Discourse Conventions

Linguistic and metalinguistic schemata mentioned earlier are aids to reading comprehension. In addition, authors use certain conventions as they present information to us in both narrative and expository texts. Text schemata is knowledge of these conventions, some of which are easily identified, such as headings, signal words,

type, and format.

Ideas in discourse, however, are less tangible. To study readers' interaction with ideas, experimenters often examine propositions. These are units composed of a predicate and an argument--roughly, simple sentences (Meyer, 1977). Warren, Nicholas, and Trabasso (1979) list seven types: (a) A proposition of state gives the objective condition of the world or of a character. (b) An event is an occurrence or action. (c) Actions are voluntary external behaviors. (d) Cognitions are mental activities of the protagonist. (e) Displays are involuntary external movements. (f) Impulses are involuntary internal reactions. (g) Goals are held by the protagonist.

## Narrative Text

Narratives in Western writing tend to have predictable elements occurring in a planned order. Rumelhart (1975) called this pattern a story grammar; others have adapted this idea with several variations. Thorndyke (1977) divided the parts of a story grammar into setting, theme, plot, and resolution. Stein and Glenn's (1979) grammar consists of a setting (time, place, and protagonist) and an episode (initiating event, internal response, attempts, consequence, and reaction). In the Stein and Glenn experiments, very few propositions from the original story were remembered exactly by either first or fifth graders. Both groups recalled major settings, initiating events, major goal statements, and consequences most of-

ten. There were developmental differences in favor of the fifth graders in total recall, the recall of internal responses and the number of added inferences.

Story summaries differ by age in content and organization (McConaughy, 1980). Young children retell the story at a simple descriptive, literal level. Sixth graders reveal an information-processing schema as they inference how's and why's. Adults supply motivation, a social-inference schema. Willows and Ryan (1986) suspect that grammatical sensitivity, vocabulary, and reading comprehension reflect some common superordinate language-processing abilities that are maturational, perhaps genetic, in nature. Even so, teachers might lead children through artful questioning to examine elements at more advanced levels (scaffolding?).

Knowledge of story grammars reduces processing demands. How bewildering it must be for the child who has not heard stories before coming to school! (Do TV shows equip children with the same sort of story grammar?) Whaley and Spiegel (1982) taught story grammars successfully to fourth-graders, who outperformed a control group in comprehension. As children develop a story schema, they can better comprehend, anticipate, and enjoy stories that they hear and read, as well as write for themselves.

**Expository Text**

Most children do not comprehend exposition as well as narration even when the content is held constant. They do improve, however,

when shown how to use such strategies as map construction (Berkowitz, 1986), mnemonic imagery (Peters & Levin, 1986), or a schema for narration to assimilate and accommodate expository patterns (Freedle, 1979).

These patterns include description, time sequence, comparison-contrast, cause-effect, definition- example, and problem-solution. Van Dijk and Kintsch (1983) describe macrostructures and microstructures of texts. Headings, directional sentences provided by the author, and transition words help identify the "big picture." Lexical, syntactic, and semantic clues signal micropropositions and the predicted order of English sentences.

Readers instantiate slots up and down the hierarchical ladder of schemata at four overlapping processing levels: letters, syntax, semantic clues, and interpretation (Adams & Collins, 1979). Specific data, or subschemata, may evoke superordinate schemata up the ladder. Examples include: (a) letters suggesting other letters and words, (b) syntax ("a" is followed by a noun phrase), (c) semantic clues, and (d) interpretive signals (the author Aesop may indicate a fable).

At the same time, schemata at the "top" may elicit such subschemata as: (a) an expected word and a search for letters to confirm it, (b) sentences (beginning perhaps with a noun phrase) at the syntactic level, (c) words and micropropostions to satisfy expected meaning at the semantic level, and (d) story form (fable, for example) which may spark interpretations and a search for outcomes

(a moral).

Students will have better recall if they make use of text structure schemata (Ohlhausen & Roller, 1988), the author's particular organizational pattern (Meyer, 1977), and macropropositions such as thematic organizers (Risko & Alvarez, 1986). It seems to be the macrostructure, not the original text, that the reader remembers (Kintsch & van Dijk, 1978).

Good rhetorical form facilitates comprehension, and texts which are better organized are better remembered (Alvermann, 1987). Anderson and Armbruster (1984) list coherence, unity, audience appropriateness, as well as attention to the kind and amount of knowledge as features of "considerate text."

Of course, not all discourses have neatly packaged structures, controlled vocabulary, or only one organizational pattern. In addition, schemata for these forms are culturally specific and vary with social context and linguistic patterns. But avoiding use of inconsiderate text entirely may be a disservice to students in the long run; experience with unfamiliar characteristics helps readers deal with them in the future (MacGinitie, 1984).

## Failure to Comprehend

Schema theory can help explain failure to comprehend. Adams and Collins (1979) attribute lack of comprehension to limitations of either data or resources. Garner (1987) and Rumelhart (1980) list three causes for failure to comprehend.

I. **First, the text clues may not be adequate to activate schemata that the reader possesses.** The data may be limited by (a) poor quality of input, such as, illegible handwriting or incoherent text, or (b) the memory may lack the necessary structures, for example, word recognition ability or knowledge of the language. In either case, no amount of effort on the reader's part can immediately solve the problem. Such would be the case in text written in an unfamiliar language or so inconsiderate that it is incoherent to even expert readers (Adams & Collins, 1979). Distractions or complex processing requirements that compete for the reader's attention are resource limitations. These are within the reader's control.

II. **Second, the reader may not have appropriate schemata, or what he or she does have may be incomplete or fuzzy.** Or sometimes the confusion occurs in unclear **relationships** among the schemata (Bransford, 1984). Here, again, the reader does have some control and can modify or create schemata by means of accretion, tuning, or restructuring (Rumelhart, 1980; Garner, 1987; Norman, 1982).

**Accretion**, adding new information to preexisting schemata, does not create a new schema, but the one in place becomes more adaptable. This is most typically associated with fact learning.

**Tuning** makes concepts either more specific or general. More specific schemata facilitate faster, more detailed interpretations with the need for fewer default variables. Concept generalization,

on the other hand, is modification in a more abstract direction and permits interpretations of more varied situations. Expertise develops from the frequent use and feedback associated with tuning.

Accretion and tuning do not create new schemata but rather adapt old ones. **Restructuring** or copying an old schema by analogy can create a new schema (Rumelhart and Norman, 1973, in McNeil, 1987; Garner, 1987). But analogies are not made easily or independently even by college students. The challenge to educators is to develop appropriate analogies and to show students how to generate them for themselves. Restructuring opinions requires a major change in position. McNeil (1987) suggests such practices as deliberately creating "cognitive dissonance," reading the text from different perspectives, using an inquiry approach, and employing the dialectical method (Collins in McNeil, 1987).

Constructing a schema is not the same task as activating an existing one. Textbooks, written and edited by adults who need employ only activation, may inadvertently contribute to confusions by assuming the reader knows more than she or he does (Bransford, 1984).

Lessons that clarify information and reveal its significance help students construct schemata and facilitate memory (Bransford, 1984; Sundbye, 1987). Bransford refers to precise and imprecise elaborations. An imprecise elaboration may result in even poorer recall than no elaboration at all. Consider a statement such as "the tall man purchased the crackers." Adding the imprecise elaboration "from the clerk in the store" does not reduce the arbi-

trary nature of the statement. More helpful is the precise elaboration, "from the top shelf" (Bransford, 1984).

**III. A third failure in comprehension may result when the reader makes an interpretation but not the one intended** (Anderson, 1984; Glover, 1990; Pace, Marshall, Horowitz, Lipson, & Lucido, 1989; McNeil, 1987).

Sometimes the fault may be unclear or misleading text as discussed in the first cause for failure to comprehend. But often the misinterpretation arises from the reader. In either case, if the faulty reasoning goes undetected, it may surface later to cause further misunderstanding. If it is detected and many such misinterpretations accrue (perhaps because the readers' background is quite different), the learner may come to believe that she or he cannot learn.

We begin to see now that preexisting knowledge can interfere with comprehension as well as aid it. Prior knowledge can evolve from episodic memory as well as semantic, and it is affected by personal beliefs and other affective and sociocultural influences. We have seen that some inferences can be quite resistant to change (Warren, et al., 1979). This is so even in the face of conflicting, seemingly convincing evidence (Pace, et al., 1990).

Science educators have been particularly concerned (Carey, 1986), but this phenomenon also affects other content areas, e.g. stereotypes may restrict learning in esthetic values, problem-

solving, and social and political beliefs.

This commitment to prior conceptions, right or wrong, may in part explain why context clues are often as misleading as helpful to a student trying to understand the meaning of words. Context clues facilitate comprehension in some instances, particularly when the word is redundant or in textbooks where the author assumes that the term is unknown. But Schatz and Baldwin (1986) found that context clues in uncontrived texts (that is, texts not developed solely for practice in determining meaning from context) were not as helpful as educators have assumed. In addition, their subjects were as certain of meanings that they inferred incorrectly as they were when they were correct. Was the first point of error in interpreting the sentences containing the unknown words? Or did faulty prior knowledge about the topic lead them to infer the vocabulary meaning incorrectly? Either way, not only was there a misconception about the meaning of <u>one</u> word or term, but the errors could conceivably be compounded in later reading if subjects hold onto their schema as tenaciously as reported in some of the misconception studies.

Similarly, prior knowledge can aid (Taft & Leslie, 1985) or inhibit word recognition. Notice, for example, how prior knowledge operates to predict words in this passage.

> Tomorrow was the annual, one-day fishing contest, and fishermen would invade the place. Some of the best bass guitarists in the country would come to this spot (source unknown).

## Limitations of Schema Theory

Schema theory has several limitations. Spiro, et al. (1978) fault the overly rigid, prepackaged compartments and echoes my biggest criticism, the tendency to "neaten" complexities, assuming more regularity than warranted. Each learning situation complexly networks with super- and subordinate prior knowledge, so it is a puzzle to imagine how an accurate schema can surface that is prepackaged, yet flexible and sensitive enough to link with a unique context.

Determining whether information was not accessed or never stored to begin with is a thorny problem that schema theory does not resolve to my satisfaction. What is the distinction between comprehension and memory? Maybe "learning" implies the intent, even the unconscious intent, to remember. Most of us have had the experience of finding something we have written of which we have no recollection whatsoever. But then we also have the contrary experience of understanding some item or concept and remembering related data we had no idea we had ever "stored." Perhaps it was stored <u>because</u> it was not understood at the time. Does schema theory provide for miscellany? The more I think about this, the more muddled I become.

Researchers design ingenious studies to unravel the tangle of schema theory, but I remain confused about how to interpret their findings. In my opinion, schema theory makes too much of an attempt to fit something as evidently complex as knowledge acquisition, storage, and retrieval into a simple, familiar framework-prototype.

Prior knowledge is a reasonable concept, but depicting it as nearly concrete structures organized along the lines of some convenient model with which we are already comfortable is a bit of "stretch." Learning and remembering must be very unlike any comparison we can make at present, otherwise we would probably be able to understand them well. It is intriguing to think that cognitive scientists' prior knowledge of schema theory may be interfering with their ability to discern another explanation.

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